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(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 761 450 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.03.1997 Bulletin 1997/11

(51) Int. Cl.[6]: **B41J 2/175**

(21) Application number: **96113482.2**

(22) Date of filing: **22.08.1996**

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **23.08.1995 JP 215085/95**

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(54) Ink cartridge package and packaging method

(57) A method of packaging an ink cartridge (100) containing ink to be supplied to a nozzle (4) places ink cartridge (100) into internal case (200) such that nozzle (4) is positioned in front of a nozzle presser (203) formed using an elastic material; ink cartridge (100) and internal case (200) are then placed inside a bag-shaped component (300), and bag-shaped component (300) is sealed under reduced pressure. As a result, the ink cartridge (100) can be packaged without the use of any adhesive which might clog nozzle (4), and without the need for any dedicated pressurizing component.

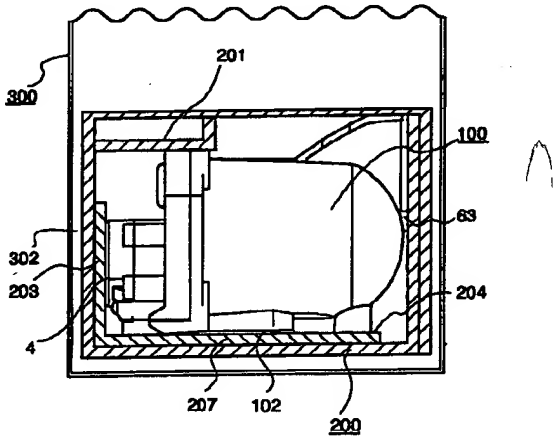

FIG. 5

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Description

The invention relates to a package for packaging an ink cartridge of an ink jet printer, and more particularly to an ink cartridge packaging method for securely sealing the ink ejection area of an ink cartridge using a sealing component.

Ink cartridges are used as ink source for ink jet printers. When the ink of one cartridge has been used up the cartridge is replaced by a fresh one or refilled. An ink cartridge includes ink supply or ink storage means and at least one opening or ink ejection area for discharging the ink contained in the cartridge. There are types of ink cartridge having an ink jet head integrated therewith. In such case the nozzles of the ink jet head are the opening for ink discharge. For shipping such ink cartridges care must be taken to package them such that no ink flows out of the ink ejection area.

As disclosed in JP-A-3-234659 and US-A-5,262,802, a conventional packaging method provides a pressurizing component for pressing a sealing component against the ink ejection area of an ink cartridge, thereby sealing the ink ejection area. When the sealing component contacts the ink ejection area, the ink seeps out through capillary action, making it difficult to completely close the ejection area using only the sealing component. Consequently, it is necessary to use a dedicated pressurizing component in addition to the sealing component to cover the ink ejection area to achieve a tight seal. The document also discloses that a sealing component possessing an adhesive is directly adhered to the ink ejection area to close the ink ejection area. The ink ejection area is sealed by the sealing component and then the ink cartridge and the dedicated pressurizing component are put into a package before the ink cartridge is shipped. Because the adhesive surface of the sealing component is pressed against the ink ejection area, the adhesive may enter the ink ejection area or the adhesive may stick to the area around the ink ejection area when the ink cartridge is sealed for an extended period of time, causing problems such as printing quality degradation.

EP-A-0 559 206 discloses an ink cartridge and a cartridge cover for hermetically sealing an ink supply port and a waste ink suction port. The cartridge cover has rubber members attached thereto which are pressed against the ports when the cartridge cover is mounted to the cartridge. The thus sealed cartridge is placed in a box shaped package for shipment. In an embodiment in which the ink cartridge has an ink jet head as an integral component a cap is provided for sealing the nozzle openings of the ink jet head for shipment or during non-use of the cartridge. The cap has a protective member sticking to the nozzles when the cap is mounted to the ink cartridge.

The object of the present invention is to improve the sealing performance (the sealed characteristics of the ink ejection area) without using an adhesive and without using any dedicated pressurizing component.

This object is achieved by the package of claim 1 and by the packaging method of claim 8. Advantageous embodiments are set forth in the dependent claims.

When there are two locations that must be protected, such as the nozzle and the terminal, both of these can be sealed using a single sealing component, resulting in cost reduction. Therefore, the terminal pressing component and the nozzle pressing component should preferably be formed as a single unit.

An ink cartridge packaged according to the present invention can protect the terminal area even if the nozzle is not sealed completely and the ink leaks. Therefore, the ejection area of the ink cartridge and the terminal area should preferably be formed on different surfaces.

The invention will be explained below in more detail with reference to the drawings which show specific embodiments only, wherein:

Fig. 1 is a perspective view of an ink cartridge placed on an internal case forming part of an embodiment of a package according to the present invention,

Fig. 2 is a perspective view showing the state in which the internal case of Figure 1 has been assembled,

Fig. 3 is a perspective view showing how the internal case holding the ink cartridge shown in Figure 2 is inserted into the aluminum pack,

Fig. 4 is a perspective view showing the state in which the ink cartridge package shown in Figure 3 has been completely packaged,

Fig. 5 is a cross-sectional view showing the ink cartridge housed inside the aluminum pack shown in Figure 3,

Fig. 6 is a side view showing the state of the ink cartridge package shown in Figure 4 in which the pressure inside the aluminum pack housing the ink cartridge has been reduced,

Fig. 7 is an exploded perspective view showing an embodiment of an ink cartridge that may be packaged according to the present invention,

Fig. 8 is a cross-sectional view showing the area around the ink jet head connection unit of Figure 7, and

Fig. 9 is a perspective view of an ink cartridge placed on an internal case forming part of another embodiment of a package according to the present invention.

Figure 1 is a perspective view showing an ink car-

tridge 100 and an internal case 200 for packaging the ink cartridge according to the teachings of the present invention. As will be explained in more detail later with reference to a particular example, an ink cartridge to which the present invention may be applied has ink supply means for storing ink therein and an ejection area (referred to as "nozzle" hereinafter) for discharging ink.

When the ink cartridge is left idle for an extended period of time, the water in the ink near nozzle 4 evaporates, increasing the viscosity of the ink. Also, if the ink cartridge is dropped or is subjected to a shock, air bubbles are sucked into the cartridge through the nozzle 4. An ink cartridge in such a state can no longer eject the ink correctly.

Furthermore, during the transportation the ink cartridge may be subject to shocks which cause the ink to leak through nozzle 4, contaminating the ink cartridge itself or its surroundings. Therefore, before the cartridge is shipped, it is necessary to seal nozzle 4 to prevent such problems and yet allow consumers to easily open the package. The ink cartridge package and packaging method according to the present invention are explained below with references to Figures 1 through 6.

Referring to Figure 1, internal case 200 holds ink cartridge 100 in a specified position during packaging. This internal case 200 consists of a cushioning material such as water-resistant corrugated cardboard, and as shown in the figure, is made in the shape of an opened cube (shown assembled in Figure 2) large enough to enclose ink cartridge 100. The surface which the back of ink cartridge 100 contacts when internal case 200 is assembled is provided with hole 202 through which a protrusion 63 of the ink cartridge is loosely inserted; and the surface which the top of ink cartridge 100 contacts is provided with step 201 which pushes the ink cartridge downward after the assembly is completed.

The surface which nozzle 4 of the ink cartridge contacts is provided with nozzle presser 203. Although nozzle presser 203 is made of PU (polyurethane) foam in this embodiment, another material such as styrol resin or flexible rubber can also be used. Plastic film 204 is fastened to the surface of nozzle presser 203 with a double-sided adhesive tape, for example, or with adhesive on the surface of plastic film 204 facing nozzle presser 203. The surface of plastic film 204 contacting nozzle 4 is not coated with any adhesive agent.

The PU foam constituting nozzle presser 203 is adhered to the case such that it straddles the surface portions that contact nozzle 4 of the ink cartridge and terminal area 102 (shown in Figure 7) on the bottom of ink cartridge 100. When the case is assembled to pack the ink cartridge, nozzle 4 and terminal area 102 become covered by plastic film 204 adhered to the PU foam. In this way, area 207 of the PU foam functions as a terminal presser.

During the packaging process, ink cartridge 100 is placed on internal case 200 as shown in Figure 1 and then internal case 200 is bent along several bending areas 205 to form the shape shown in Figure 2.

During this process, because protrusion 63 of the ink cartridge is inserted into hole 202 of the case, ink cartridge 100 will not shift in the direction of arrow a or b shown in Figure 2. Furthermore, because ink cartridge 100 is pressed in the direction of arrow c by step 201, terminal area 102 on the bottom of the cartridge is also pushed against plastic film 204 on the PU foam (terminal presser 207). As a result, terminal area 102 is covered and protected by plastic film 204 on the soft PU foam. In the state shown in Figure 2, nozzle 4 is merely touching plastic film 204 and is not completely sealed by nozzle presser 203.

After ink cartridge 100 is placed inside internal case 200 in this way, internal case 200 containing ink cartridge 100 is placed inside an aluminum pack 300 as shown in Figure 3. Internal case 200 is provided with protection areas 206 (in two places) to ensure that the sides of cartridge 100 will not touch aluminum pack 300. Protection areas 206 are bent in the direction of arrows d and e shown in Figure 3, and internal case 200 which contains cartridge 100 is then inserted into aluminum pack 300.

Figure 5 is a cross-sectional view showing the state in which internal case 200 containing ink cartridge 100 is inserted into aluminum pack 300. Aluminum pack 300 is shaped such that a gap 302 is formed between aluminum pack 300 and internal case 200. In this state, aluminum pack 300 is set in a pressure-reduction device. In one embodiment, the pressure inside aluminum pack 300 is reduced to about 250 torr (33 kPa). After the specified pressure reduction has been achieved, top area 301 of aluminum pack 300 is heat-welded as shown in Figure 4, and then aluminum pack 300 is removed from the pressure-reduction device, completing the packaging process.

After aluminum pack 300 is sealed, no external air enters the package. By reducing the pressure inside aluminum pack 300, a pressure difference results between the interior and exterior of the aluminum pack and the aluminum pack contracts as shown in Figure 6. As a result of this, a force is applied to internal case 200, inter alia in the direction of arrow f as shown in Figure 6, pushing nozzle presser 203 against nozzle 4. As a result, nozzle 4 is completely sealed by plastic film 204 and is isolated from the atmosphere. Plastic film 204 is also tightly pressed against terminal area 102 on the bottom of the cartridge.

Nozzle 4 and terminal area 102 are formed on different surfaces of the ink cartridge in this embodiment. Such a configuration is preferable to prevent ink from contaminating the terminal area should any ink leak out of the nozzle during the packaging process or after ink cartridge 100 is packaged should the packaging fail to completely seal nozzle 4.

Figure 9 is a perspective view similar to that of Figure 1 and showing ink cartridge 100 and a modified form of internal case 200 for packaging the ink cartridge. In the modified embodiment, instead of providing the step 201 in the top surface of internal case 200

which contacts the top of ink cartridge 100, nozzle presser 203 may be extended to that surface. The extended portion 211 forms a step having a function equivalent to step 201 in the embodiment of Figure 1. Another difference between the embodiment of Figure 1 and the modification of Figure 9 is that a hole 212 is provided in the top surface of internal case 200 so as to receive the uppermost part of a handle 64 provided on the upper back side of ink case 60. Handle 64 engaging hole 212 assists in holding ink cartridge 100 in place relative to internal case 200.

One embodiment of an ink cartridge which can be packaged according to the present invention is explained below with references to Figures 7 and 8. This particular ink cartridge is merely one example of an ink cartridge that may be packaged according to the present invention. The present invention can be applied to essentially any ink cartridge in any form.

Figure 7 is an exploded perspective view showing the configuration of the ink cartridge. Likewise, Figure 8 is a cross-sectional view of the ink jet head connection unit (area comprising ink jet head 10 and cases 30 and 40) which is part of the ink cartridge.

Ink cartridge 100 comprises an ink jet head connection unit which consists of first case component 40 (hereafter referred to as "head case 40"), second case component 30 (hereafter referred to as "nozzle case 30"), and ink jet head 10; and an ink supply area which consists of ink sack 50 and ink case 60.

Nozzle case 30 is made of a resin such as AS, ABS or PSF (polysulfone). A nozzle plate 31 equipped with opening 31a, through which nozzle 4 appears when ink jet head 10 is mounted, is provided in the center of nozzle case 30. Ink-stop groove 32 is provided around said nozzle plate 31. This ink-stop groove 32 is designed to use surface tension to retain the ink that is ejected from nozzle 4 during a priming operation. A priming operation (pressing of ink sack 50 from the outside in order to eject viscous ink or air bubbles) is used when nozzle 4 is clogged or when air bubbles inside the ink path cause an ejection failure. The ejected ink is retained inside ink-stop groove 32 through surface tension. The user performs a priming operation while observing the amount of the ejected ink. That is, the internal area of ink-stop groove 32 is preset to enable an appropriate priming operation when the ejected ink fills ink-stop groove 32.

Protruding wall 36 for forming an adhesive groove (to be described below) is formed on the external perimeter of the opening on the back of nozzle case 30. Two pins 33 for connecting to head case 40 are formed on the back of nozzle case 30 (only one pin 33 is visible in Figure 7). Adhesive injection opening 34 is provided on the bottom front of nozzle case 30, and this adhesive injection opening 34 is connected to the adhesive groove.

Head case 40 is made of a transparent material such as PSF (polysulfone), PC (polycarbonate) or ABS. Linking holes 43 are formed on part of head case 40 that faces nozzle case 30 (only one hole 43 is visible in Figure 7). Pins 33 of nozzle case 30 are pressure-fit into linking holes 43, connecting nozzle case 30 to head case 40. Opening 41, into which protruding wall 36 of nozzle case 30 is inserted, is formed in the approximate center of head case 40, and opening 42 (shown in Figure 8) which has the same shape as opening 31a of nozzle case 30 is provided in the center of opening 41. Opening 42 houses the side of ink lead-in opening 27 of ink jet head 10.

Referring now to Figure 8, nozzle 4 is formed on one end of ink jet head 10, and ink lead-in opening 27 is formed on the other end. Multiple pressure-generating elements are positioned in a line inside ink jet head 10 and are used in a manner well known to those skilled in the art to eject ink droplets through the nozzle.

Referring again to Figure 7, FPC (flexible print circuit) 101 for sending signals to the pressure-generating elements is inserted into groove 49 of head case 40. Terminal area 102 of FPC 101 is fastened to the bottom surface of ink case 60. When ink cartridge 100 is mounted on a carriage (not shown in the figure), the terminal provided in the carriage and terminal 102 of FPC 101 become electrically connected.

After assembly, nozzle case 30 is connected to head case 40 in which ink jet head 10 is housed. Referring to Figure 8, a pair of claws 37 for clamping ink jet head 10 is provided inside protruding wall 36 of nozzle case 30. Claws 37 press ink jet head 10 to the bottom of opening 42 of head case 40. As a result, the surface of ink jet head 10 on the side of ink lead-in opening 27 makes tight contact with the bottom of opening 42 of head case 40, and ink jet head 10 is supported inside head case 40 with ink lead-in opening 27 of ink jet head 10 connected to an ink supply port (not shown in the figure) provided on the bottom of opening 42 of head case 40.

As shown in Figure 8, opening 41 of head case 40 and protruding wall 36 of nozzle case 30 form a space (adhesive groove 48) around the entire outside perimeter near ink lead-in opening 27 of ink jet head 10 inside the connected case. Nozzle case 30 is provided with adhesive injection opening 34 and injection tube 35, and a dispenser provided with a hypodermic needle, for example, is used to inject an adhesive from injection opening 34 through injection tube 35 into adhesive groove 48. In this way, the area around lead-in opening 27 of ink jet head 10 is sealed by the adhesive and ink jet head 10 is fastened to head case 40.

The ink jet head connection unit assembled in this manner provides a complete connection from the ink supply area to nozzle 4. In other words, the ink supplied from ink supply tube 46 formed on the back of head case 40 is supplied to lead-in opening 27 of ink jet head 10, and is ejected as ink droplets 104 from nozzle 4 when the pressure-generating elements inside the head are activated.

An ink filling port 44 is provided on the top front of head case 40. Ink filling port 44 is plugged by press-fit plug 47 at all times other than when ink is being loaded

into ink cartridge 100. Plug 47 is made of nylon, for example, to prevent foreign material such as shreds or filings from plug 47 being introduced into the ink when plug 47 is inserted. A soft resin such as polyimide or a metal ball can also be used. Ink supply tube 46 is formed on the back of head case 40, and filter 55 is heat-welded to its opening. Additionally, multiple pins 45 for connecting the head case to ink case 60 are provided on the back of head case 40.

Ink sack 50 is made of butyl rubber, for example, and its tip consists of circular opening 51 as shown in Figure 7, and packing 52 is provided around opening 51. This packing 52 forms a sealing structure by being clamped between head case 40 and ink case 60.

To prevent the ink from leaking from nozzle 4 of an ink cartridge during a standby state in which no printing is taking place or when the ink cartridge is removed from the printer and left idle, it is necessary to constantly supply (negative) pressure to draw ink from ink jet head 10 back into the ink path formed inside ink cartridge 100. In this embodiment, the negative pressure is provided by the spring characteristics or shape restoration characteristics of ink sack 50.

Like head case 40, ink case 60 is made of a transparent material such as PSF (polysulfone), PC (polycarbonate) or ABS. Opening 61 is formed on the side of ink case 60 that faces head case 40 and which houses ink sack 50. A plurality of linkage holes 62 are also formed, and pins 45 of head case 40 are pressure-fitted into these holes, thereby connecting head case 40 and ink case 60. Protrusion 63 for positioning ink cartridge 100 during its mounting onto the carriage is provided on the back of ink case 60. As was explained above, protrusion 63 also prevents ink cartridge 100 from slipping out of internal case 200 when ink cartridge 100 is being placed inside internal case 200. Handle 64 is provided on the upper back side of ink case 60 which makes it easier to hold ink cartridge 100 during its mounting onto the carriage.

Claims

1. A package for packaging an ink cartridge (100) provided with an ink ejection area (4) and ink supply means (50, 60) for supplying ink to said ink ejection area (4), said package comprising

   a holding component (200) for holding said ink cartridge (100);
   an ejection area presser component (203) made of an elastic material for covering said ejection area (4), said ejection area presser component (203) being attached to said holding component (200) and said holding component (200) being arranged so as to hold the ink cartridge (100) such that said ejection area (4) is positioned in front of said ejection area presser component (203); and
   a bag-shaped component (300) for housing said holding component (200) holding the ink cartridge (100), said bag-shaped component (300) being adapted to press said ejection area presser component (203) against said ejection area (4) when sealed under reduced pressure.

2. The package according to claim 1 wherein a plastic film (204) is fastened to the part of said ejection area presser component (203) that contacts said ejection area (4).

3. The package according to claim 1 or 2 wherein said holding component (200) is formed from a cushioning material.

4. The package according to any one of the preceding claims wherein said bag-shaped component (300) is an aluminum pack.

5. The package according to any one of the preceding claims wherein a terminal presser (207) component is attached to said holding component (200) and said holding component (200) is arranged so as to hold the ink cartridge (100) such that an electric terminal area (102) of the ink cartridge (100) is positioned in front of said terminal presser component (207).

6. The package according to claim 5 wherein said terminal presser component (207) and said ejection area presser component (203) are formed as a single unit.

7. Use of a package according to claim 5 or 6 for packaging an ink cartridge (100) having an ejection area (4) and a terminal area (102) formed on different surfaces.

8. A method of packaging an ink cartridge (100) provided with an ink ejection area (4) and ink supply means (50, 60) for supplying ink to said ink ejection area (4), said method comprising the steps of:

   setting said ink cartridge (100) in a holding component (200) such that said ink ejection area (4) is positioned in front of a presser component (203) for covering said ejection area (4);
   housing said ink cartridge (100) holding component (200) with the ink cartridge (100) set therein in a bag-shaped component (300); and
   sealing said bag-shaped component (300) under reduced pressure.

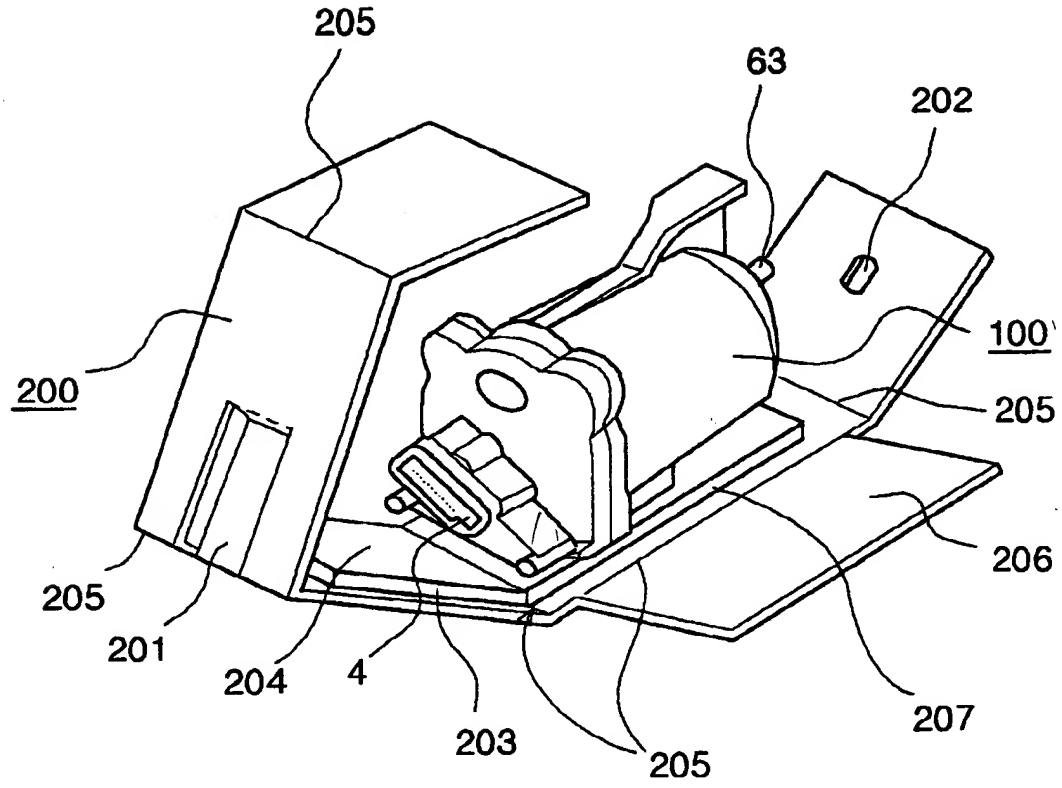

FIG. 1

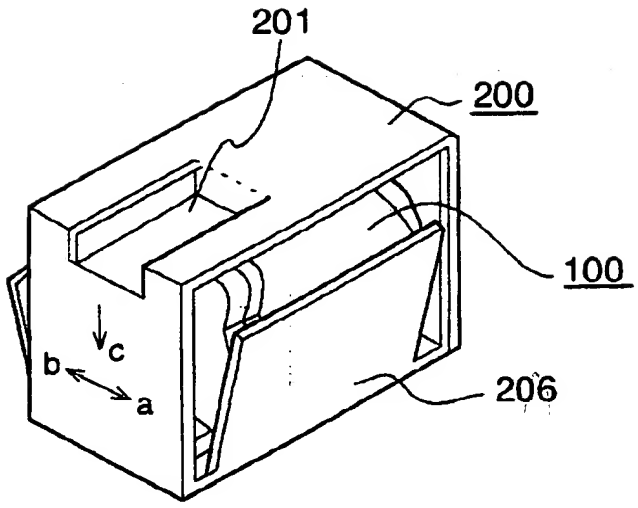

FIG. 2

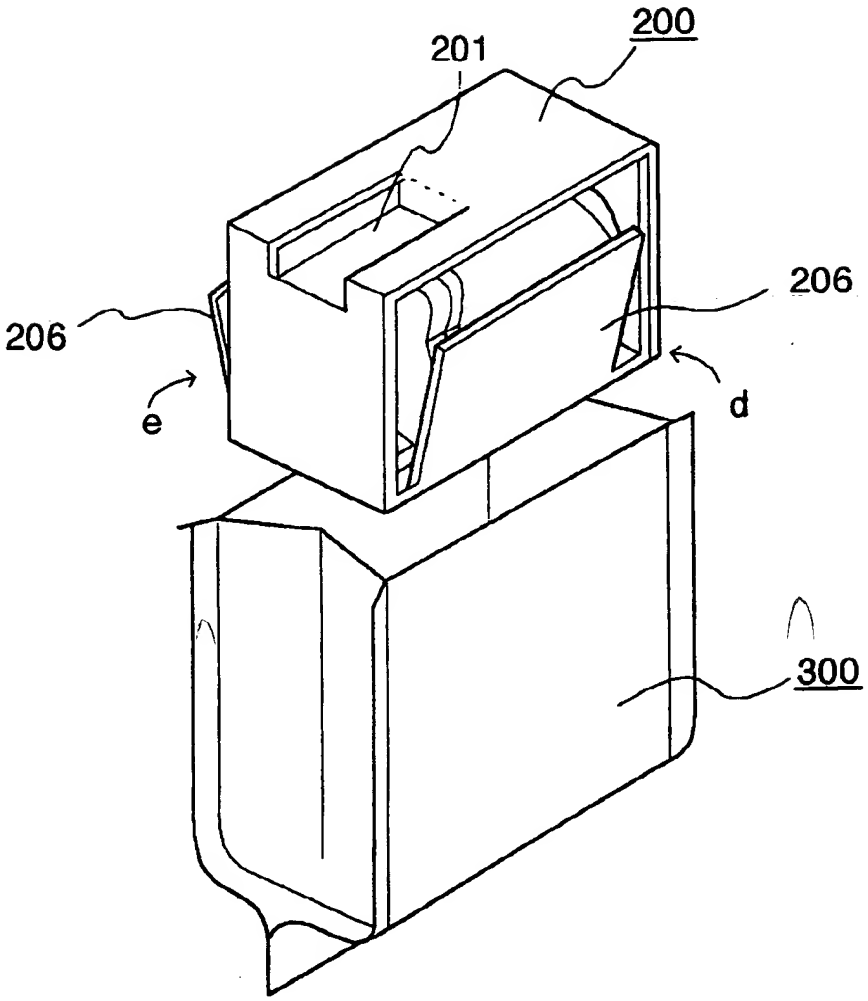

FIG. 3

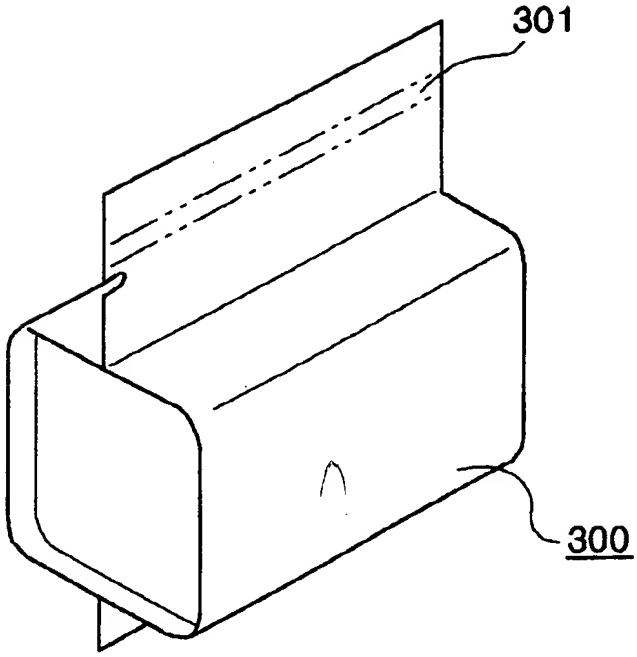

FIG. 4

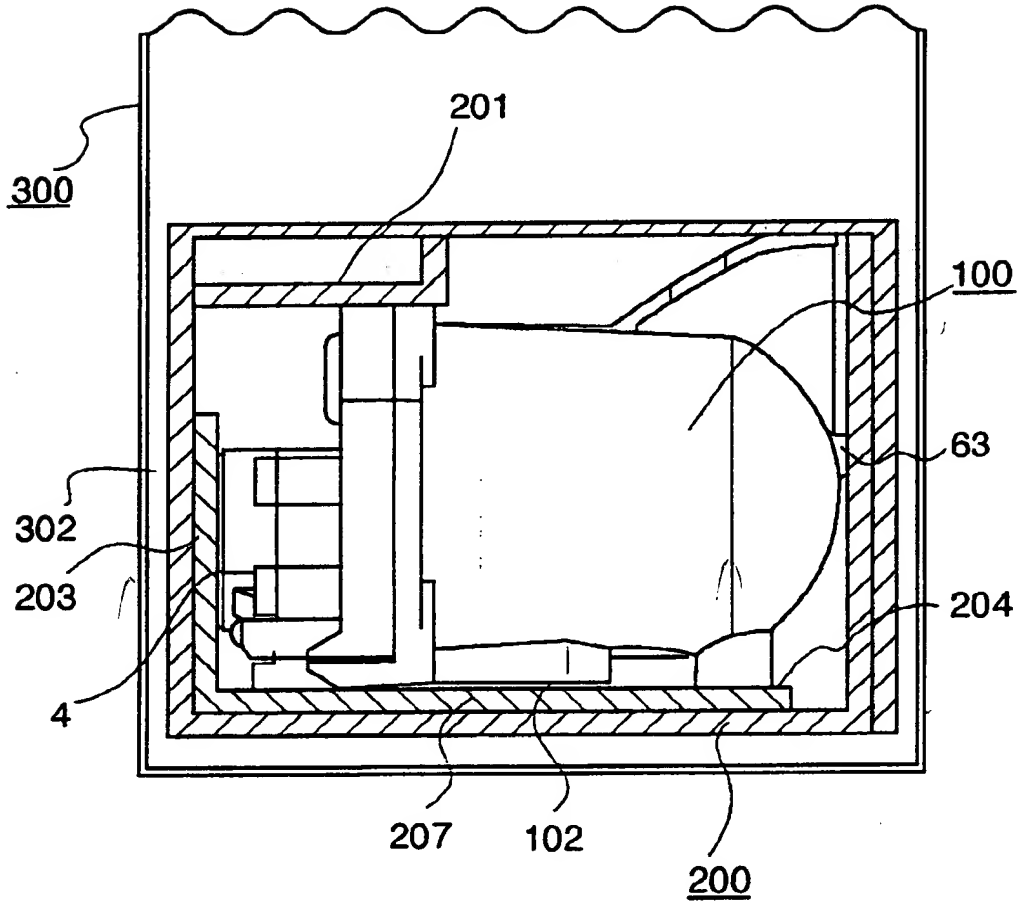

FIG. 5

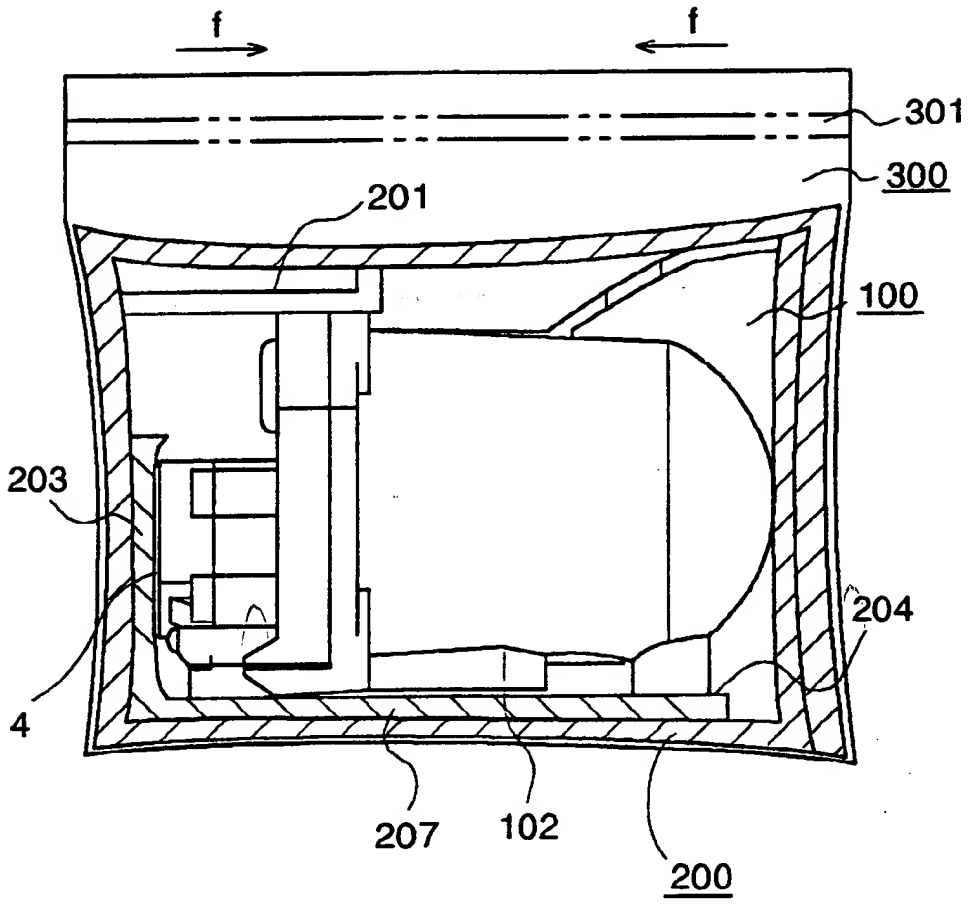

FIG. 6

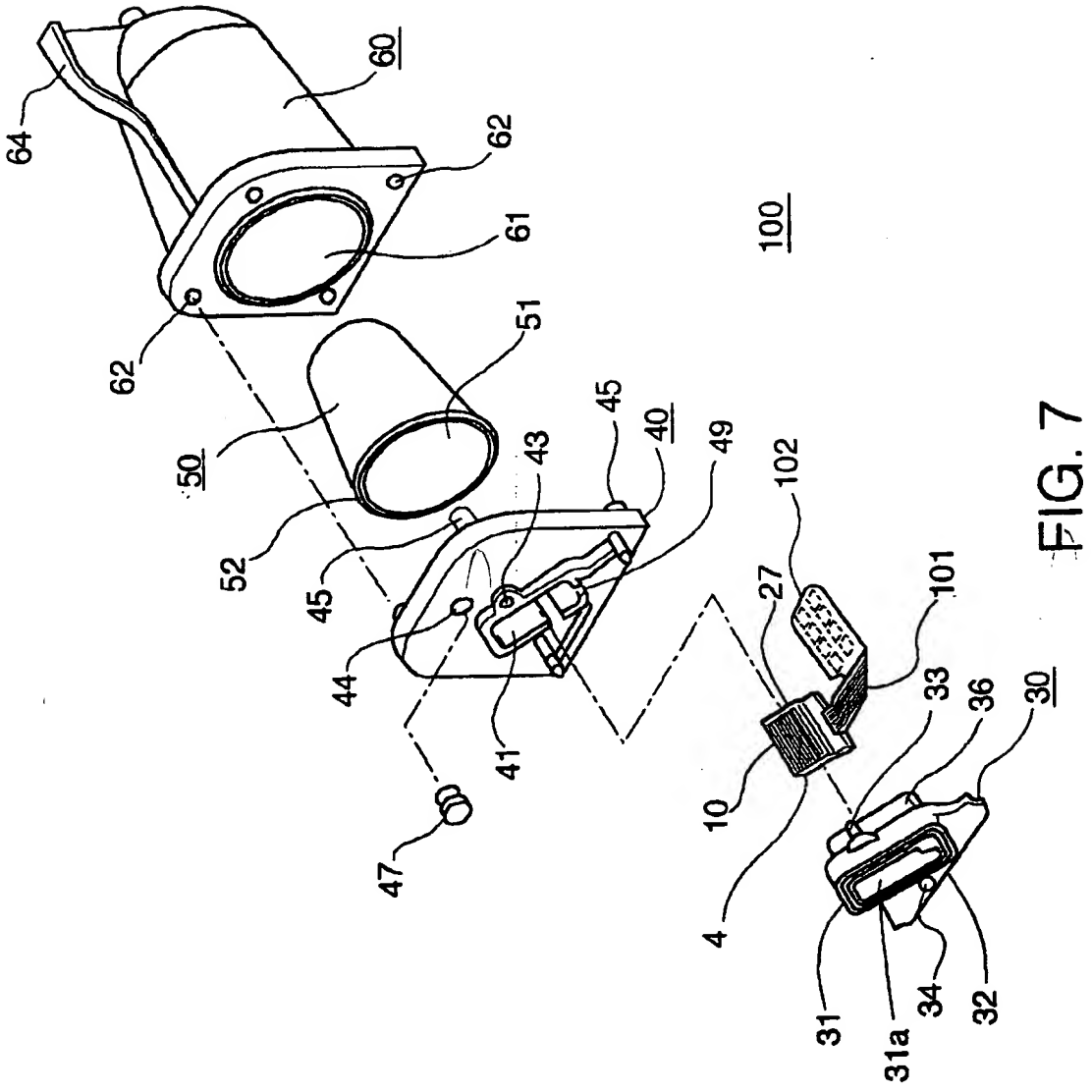
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FIG. 7

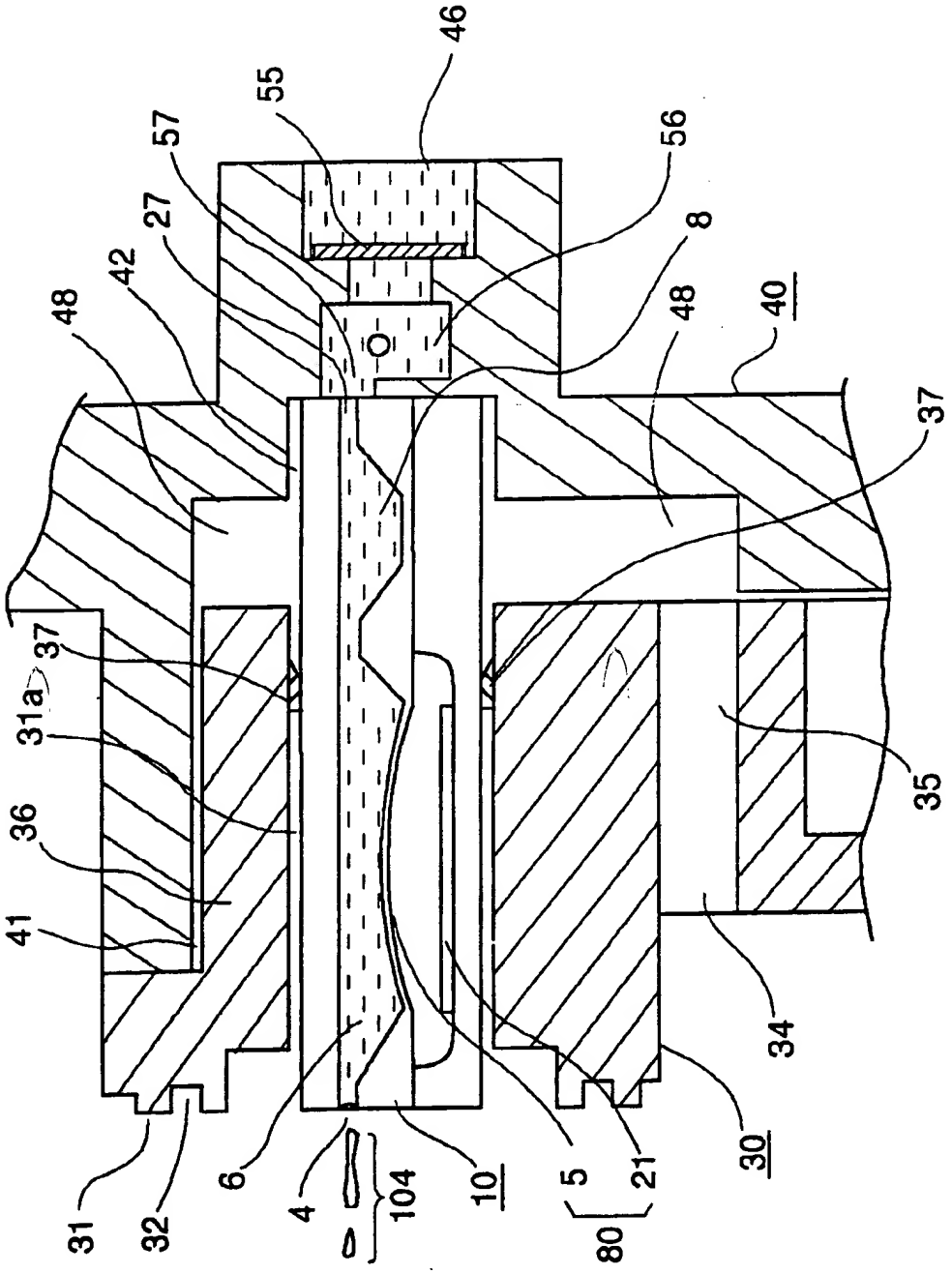
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FIG. 8

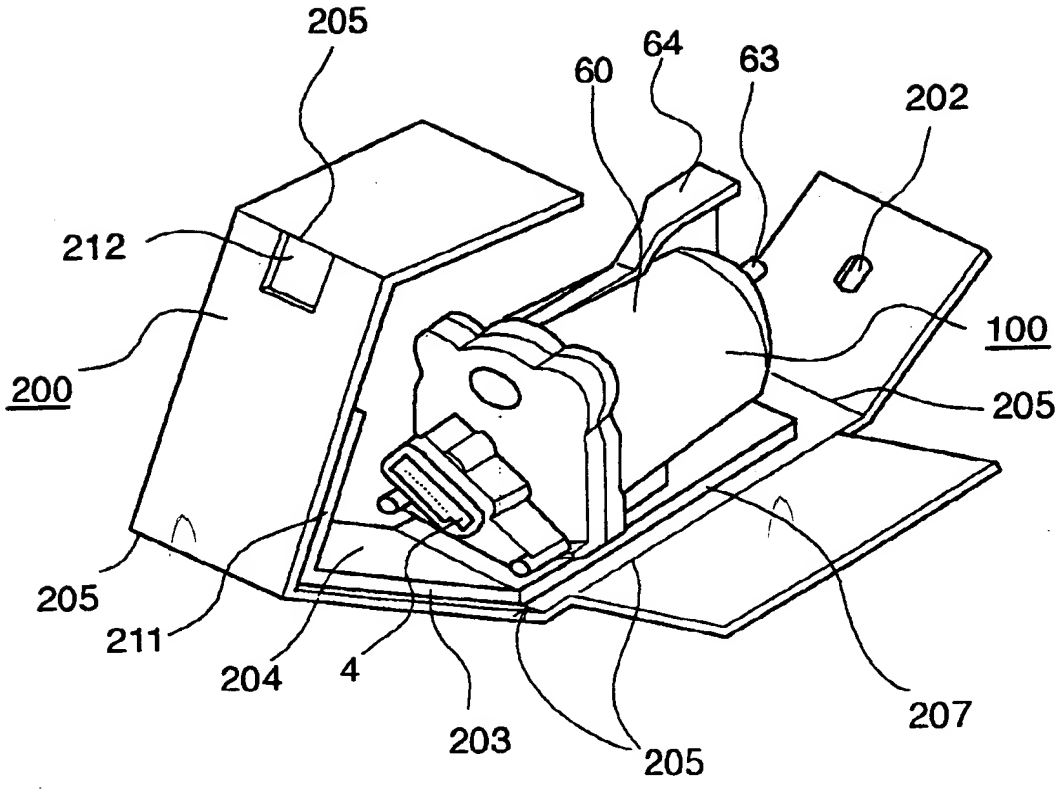

FIG. 9